

Terrestrial Sediment Accumulation in Coral Reef Areas of La Parguera, Puerto Rico

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What's the concern/hypothesis?

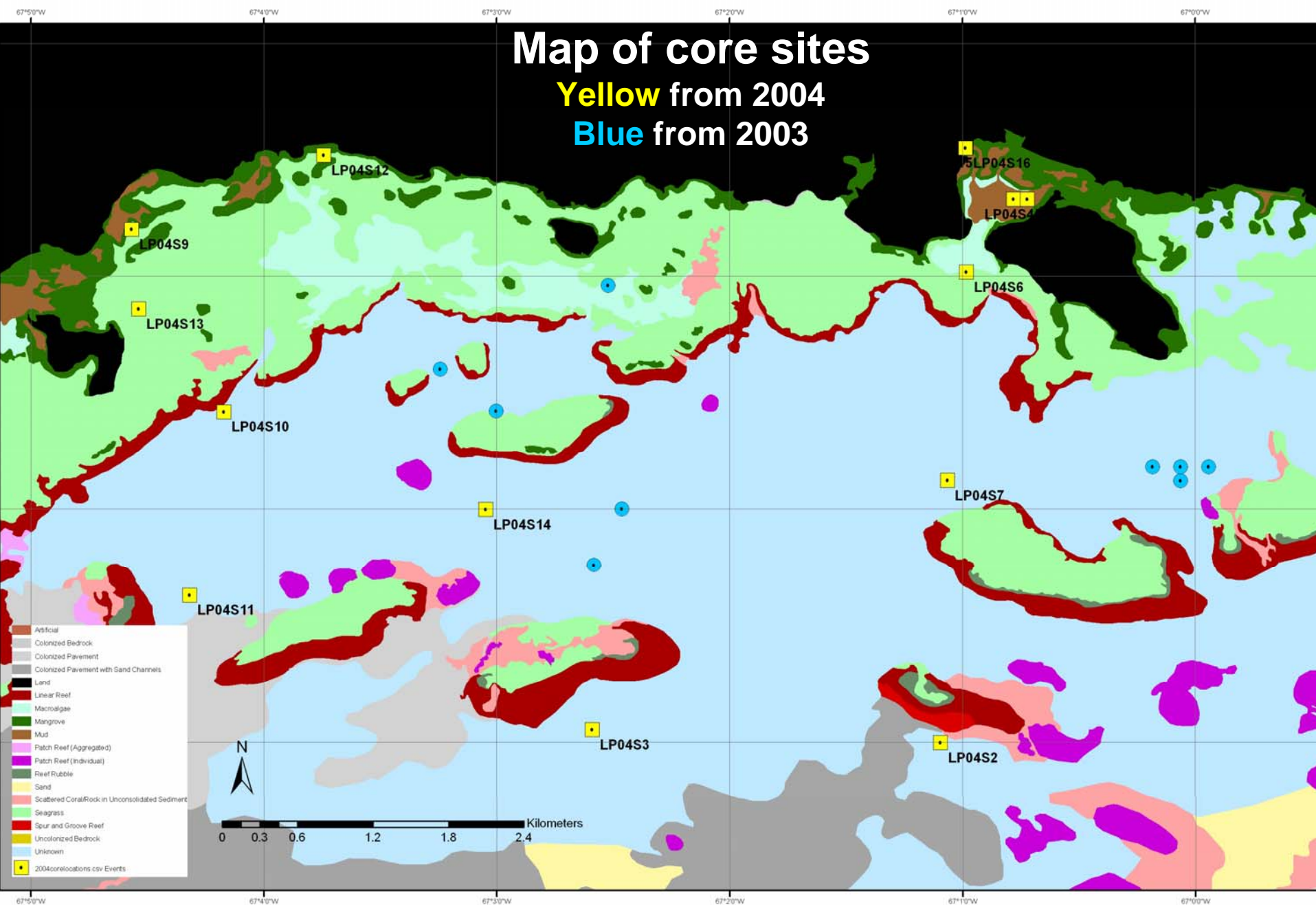
Coastal development has led to increased terrestrial sediment accumulation in coral reef areas.





Methods

- 9 cores were collected in 2003.
- In 2004, 15 additional cores in were collected in the La Parguera area.
- Cores were described, photographed and x-rayed and then sub-sampled at 1 or 2 cm intervals.
- Sub-samples from cores in 2003 were examined by alpha spectrometry, only providing data on ^{210}Pb .
- In 2004, direct gamma counting was used to determine activities of ^{234}Th , ^7Be , ^{210}Pb , and ^{137}Cs .



Core Photography and Core Descriptions



Most Cores Showed:

- Darkening toward core top.
- Fining upwards of sediments.

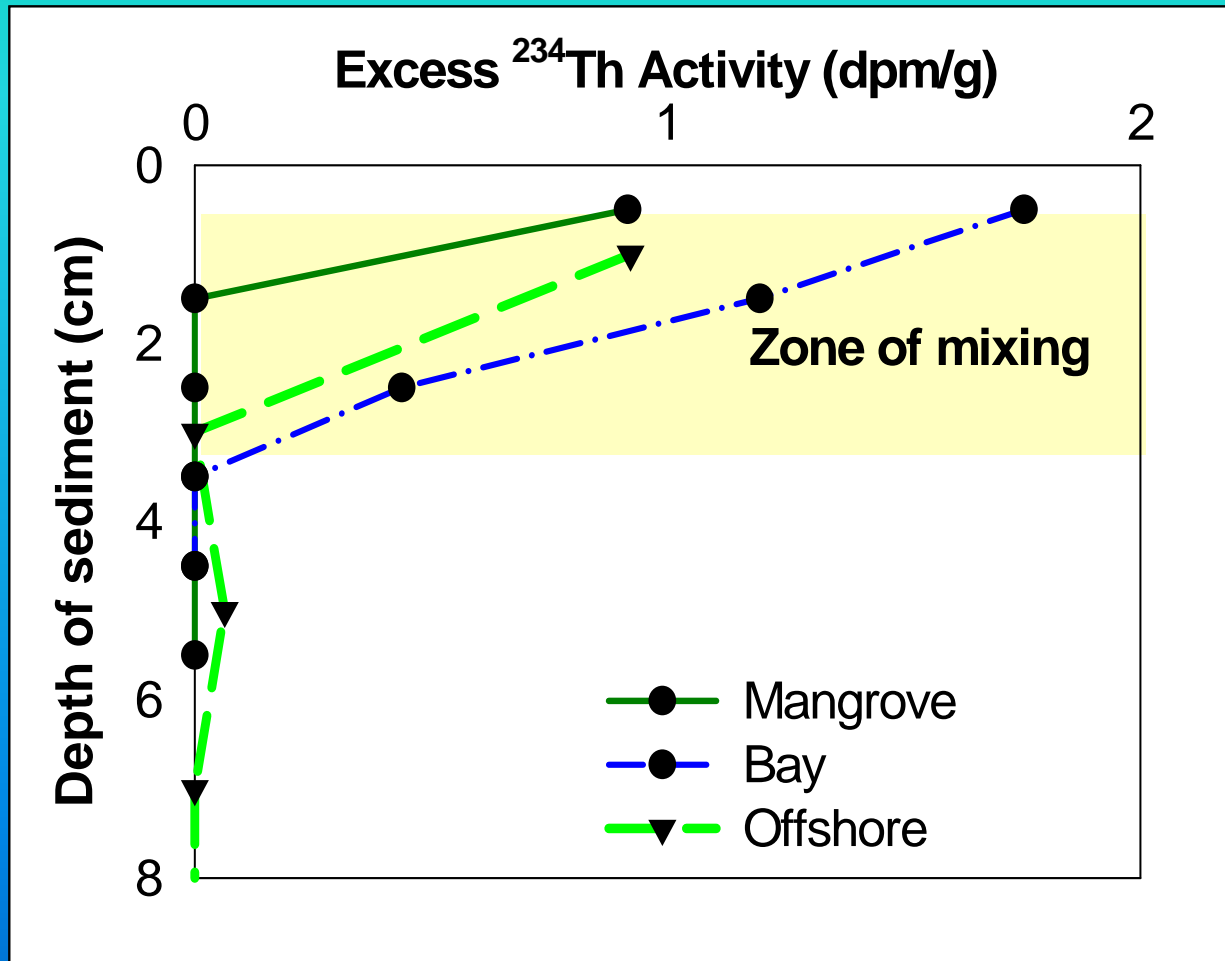
Also, some cm-thick layers of darker, finer-grained sediment were evident. Past sediment discharge events (e.g., Hurricanes)?

Direct Gamma Counting

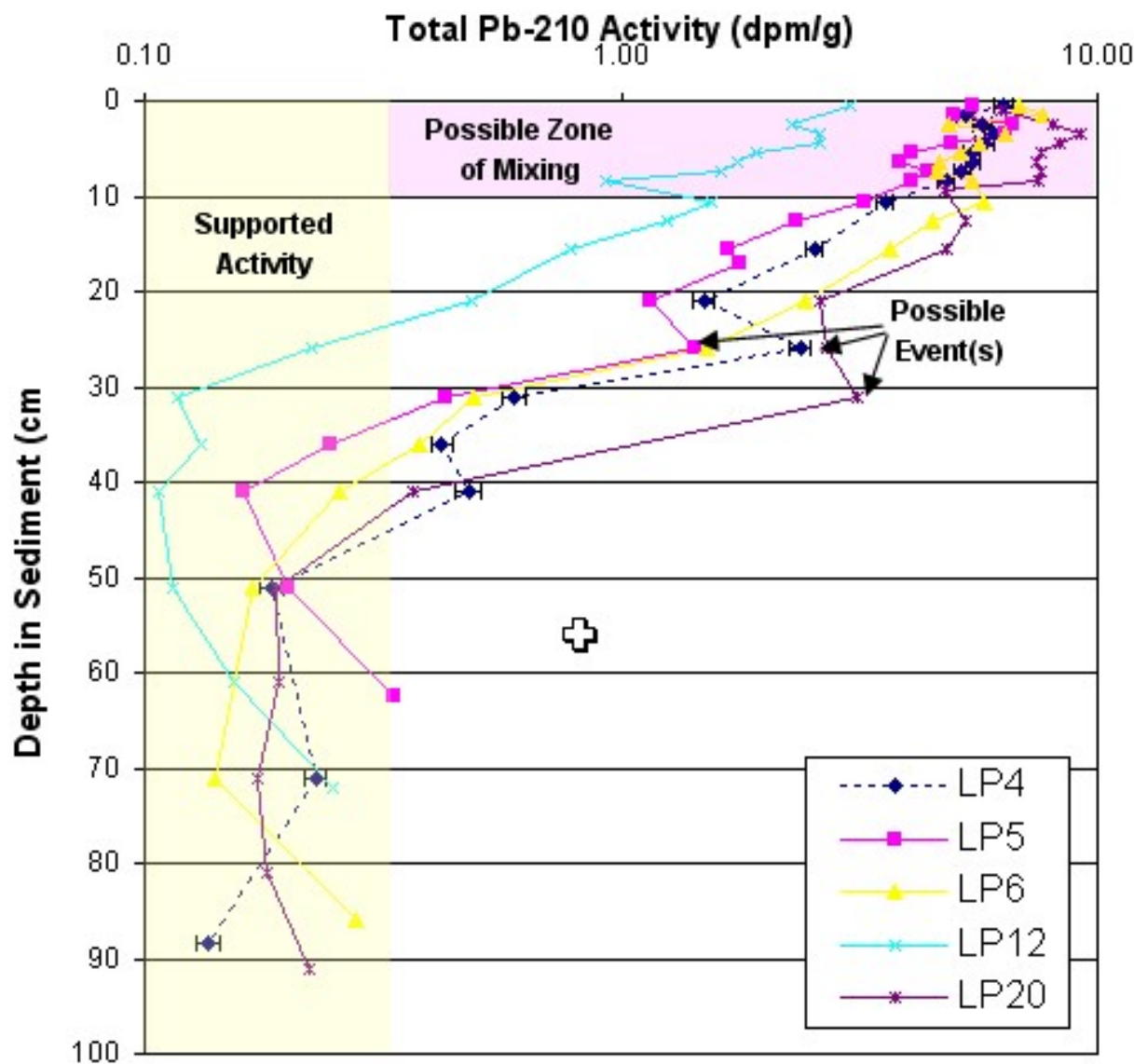


Samples were analyzed using direct gamma counting using one of three low background, high-efficiency, high-purity Germanium detectors (Coaxial-, Lege-, and Well-type) coupled with a multichannel analyzer.

Biological Mixing



- A major objective of the work in 2004 was to evaluate the impact of biological mixing.
- ^{234}Th profiles show minor biologic mixing which will have little affect on ^{210}Pb profiles
- Mixing depths ranged from 1-3 cm

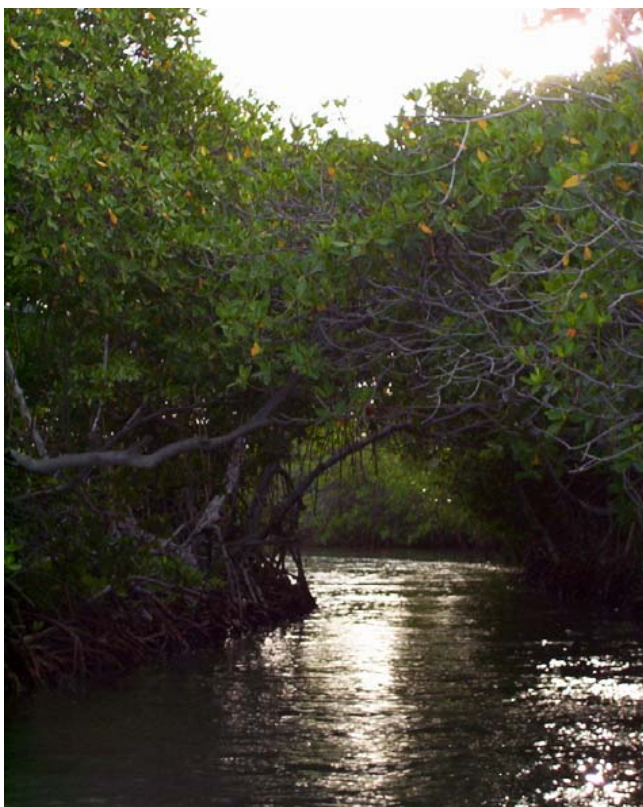


^{210}Pb Data from 2003

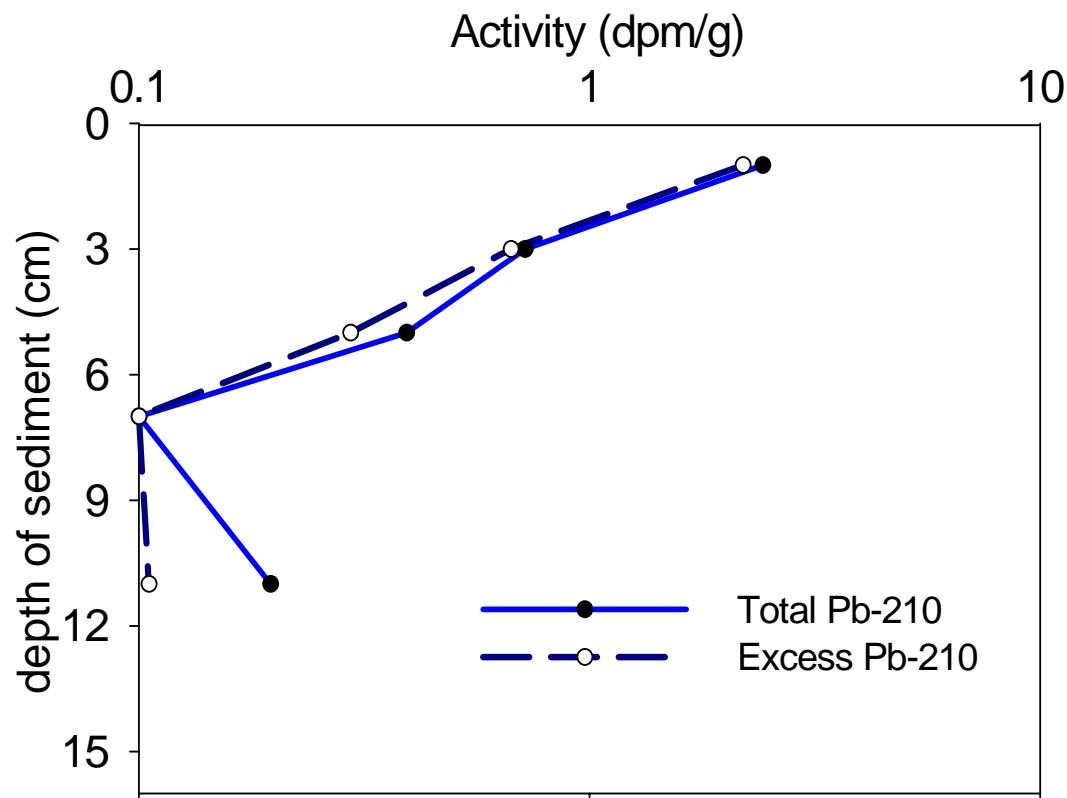
Revealed log-linear decreases in activities with depth, probably reflecting steady-state accumulation.

Prominent peaks in activity profile may be related to fine-grain layers deposited by events.

But, cores collected in 2004 sampled a greater diversity of environments.

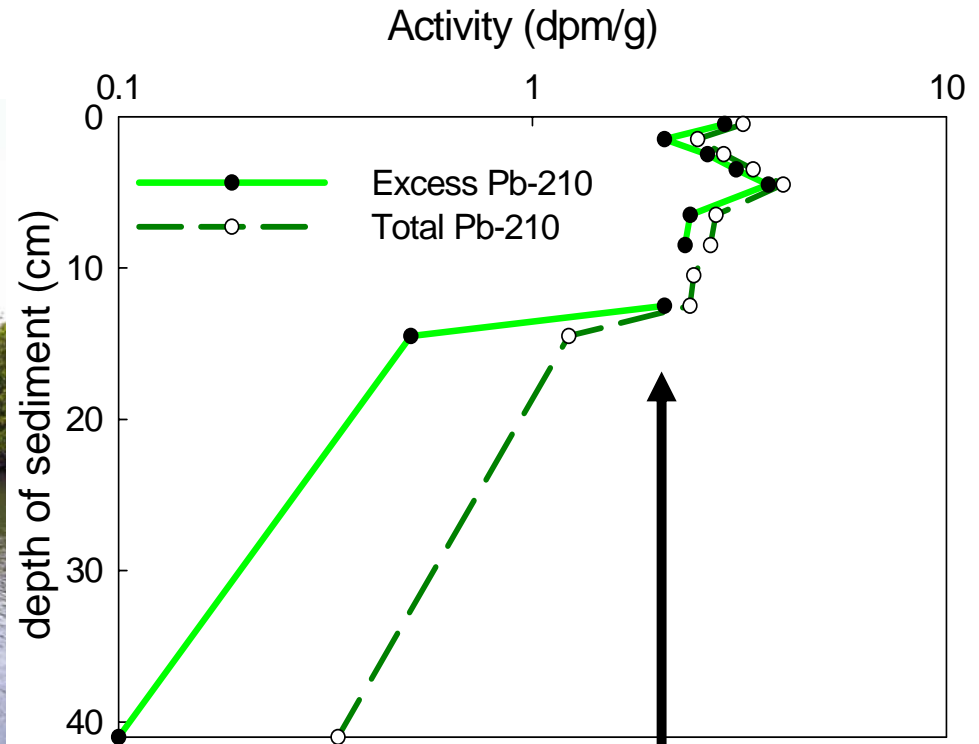


Near Shore Site



Rapid decrease of ^{210}Pb with depth suggesting a low accumulation rate. Interestingly, this core was adjacent to the mangroves where higher rates of accumulation were anticipated.

Phosphorescent Bay

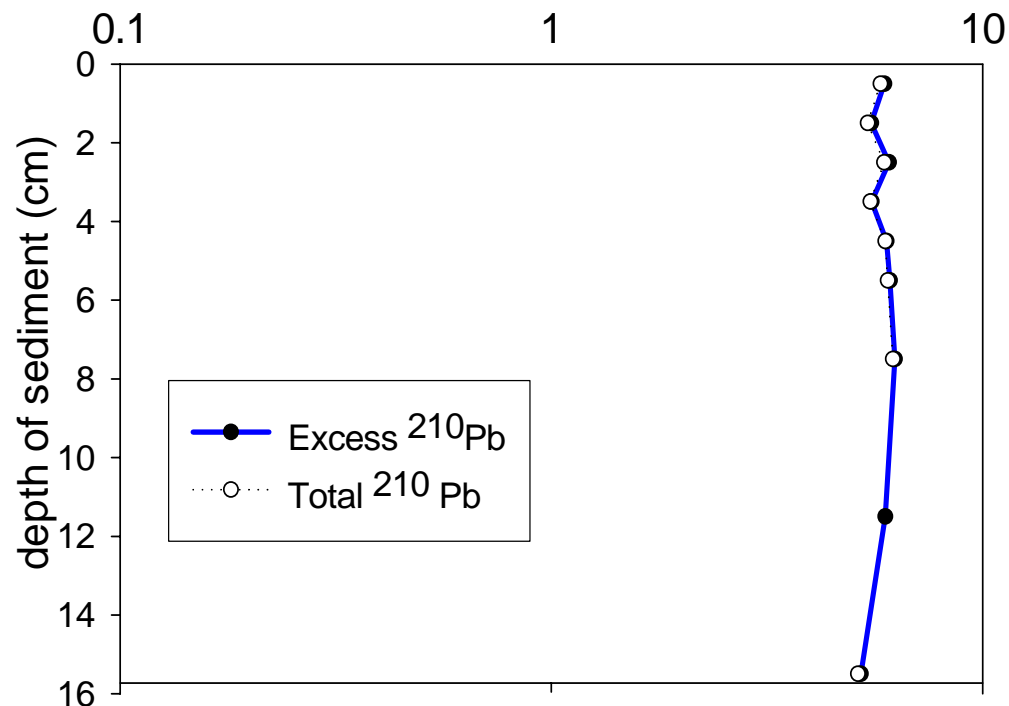


Channel closure at Phosphorescent Bay may have resulted in a change in this notable change in sediment accumulation.



Back Reef Site 7

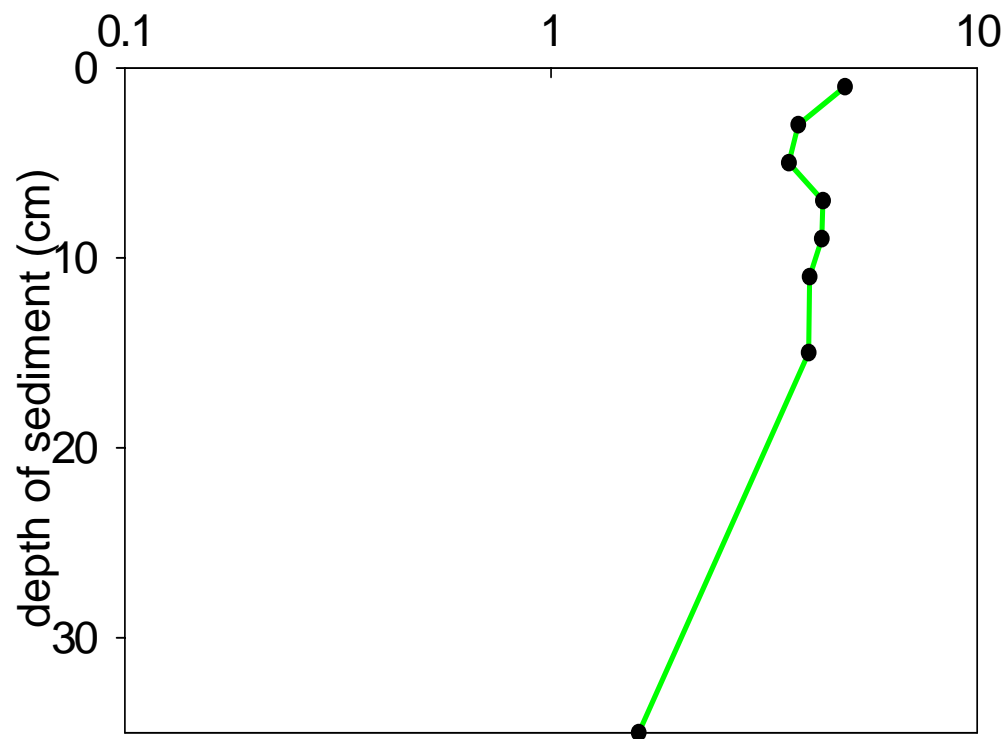
^{210}Pb activity (dpm/g)



At site 7, gamma-derived activities indicate excess ^{210}Pb in the lowest sample counted (we have more counting to do), indicative of a higher accumulation rate than some sites closer to shore.

Reef Front, Site 3

Total ^{210}Pb activity (dpm/g)



Gamma data from Site 3 suggest a steady-state profile may be found. Counting of deeper samples will be conducted.



Insights

- **Many of the cores suggest a change in the nature of sediment accumulating. Also, we observed notable variability in ^{210}Pb profiles between sites, indicating different sediment accumulation.**
- **Observations (i.e., darkening and fining upwards) point toward an increase in the percentage of terrestrial sediment accumulating at most sites.**
- **^{210}Pb profiles indicate reasonably steady-state sediment accumulation (i.e., have a log-linear decrease in activity with depth), arguing against a notable change in the 100-year (^{210}Pb) rate of sedimentation.**
- **^{234}Th data indicate that ^{210}Pb profiles are impacted little by organism mixing.**
- **Discrete layers preserved in the seabed imply sediment discharge pulses (from Hurricanes?) may be now more important in this system.**

Remaining Work

- **Carbonate % will be measured in samples from existing cores; Remainder is presumably mostly terrestrial.**
- **Trace metal analyses will be conducted to evaluate anthropogenic sources and impacts.**
- **Detailed ^{210}Pb analyses using alpha spectrometry will be made to better assess changes in sediment accumulation rates and accumulation events.**
- **Seabed record will be compared with the 100-y discharge record.**
- **Collaborate with others to evaluate how and why sedimentation varies over the entire coastal La Parguera system (temporally and spatially) and how this impacts various parts of the ecosystem.**

Thanks!

